US Army Corps of Engineers
Construction Engineering Research Laboratory

Fact Sheet

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CHILLER REPLACEMENT AND THERMAL STORAGE DEMONSTRATION PROJECT AT CERL

The Problem

Electrical consumption in cooling equipment accounts for a large portion of the Army's total energy use. The peak cooling load usually contributes significantly to the peak electrical demand, resulting in excess demand charges for an installation. New technologies are available that greatly increase the efficiency of chillers and make use of environmentally friendly refrigerants. Storage cooling systems are also available that allow the user to chill water or make ice, during off-peak periods when demand charges are much lower or nonexistent. The ice or chilled water then cools the building during peak demand hours with chillers turned off.

During the 1992 cooling season, repair work on the 25-year-old, 325-ton, R-11 centrifugal chiller at the U.S. Army Construction Engineering Research Laboratory (CERL) showed excessive wear and corrosion in the chiller's tubing section. Studies of the building demand also indicated that the chiller was greatly oversized. New regulations regarding R-11 refrigerant would make recharging the chiller expensive or impossible. CERL researchers performed a study to develop and recommend options for replacing the old system in the most cost-effective and environmentally acceptable manner.

The Technology

Research indicated that replacing the 325-ton centrifugal chiller with two 170-ton screw compressors using R-22 refrigerant and a 1500 ton-hour ice storage unit would be the most cost-effective replacement. This system would allow CERL researchers to learn more about thermal storage systems while providing a reliable cooling system for CERL. The screw compressors operate at less than 0.75 KW/ton with an output water temperature of 45 degrees as compared to the 1.2 KW/ton from the old centrifugal chiller. For reliability, each new chiller was sized to be able to meet 70 percent of the design load. The new chillers can also produce the 24 degree output water temperature required for the operation of an ice storage system.

Benefits/Savings

The chiller piping system was modified to accommodate an ice storage system. These changes resulted in a slight loss of system efficiency. However, even with this slight loss, the new system used some 35 percent less electricity than the old system over the entire operating range, reducing the peak usage from 200 KW to 130 KW. With a demand charge of $14/KW, this would result in a savings of $1,000/month ($4,000/year). An additional annual savings of almost $6,000 resulted from the reduced energy consumption. When the system went online in 1996, annual savings were projected at $15,000.

Status

Data was collected on the old cooling system during 1993 through 1994. Results from the data were used to design the ice storage system which was commissioned in Oct 96. The first year’s

performance data was collected during the FY97 cooling season. Based on the monthly electrical utility bills, the ice storage system saved $15,000 for the year, corroborating the earlier savings estimate.

Points of Contact

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